DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 128064G1 FGH-PW

Product Specification ***Version: 3***

15.09.2023

GENERAL SPECIFICATION

MODULE NO. :

DEM 128064G1 FGH-PW

CUSTOMER P/N:

Version No.	Change Description	Date
0	Original Version	06.08.2021
1	Change the LCD driver to IST3004-TX from ST7565R.	13.08.2021
2	Update the pin assignment on page 6;Update the LCD drawing on page 12 - page 15.	23.08.2021
3	Correct Backlight	15.09.2023

PREPARED BY: LM DATE: 15.08.2023

APPROVED BY: MH DATE: 15.09.2023

CONTENTS

1. FUNCTIONS &FEATURES

- DEM 128064G1 Series LCD Type

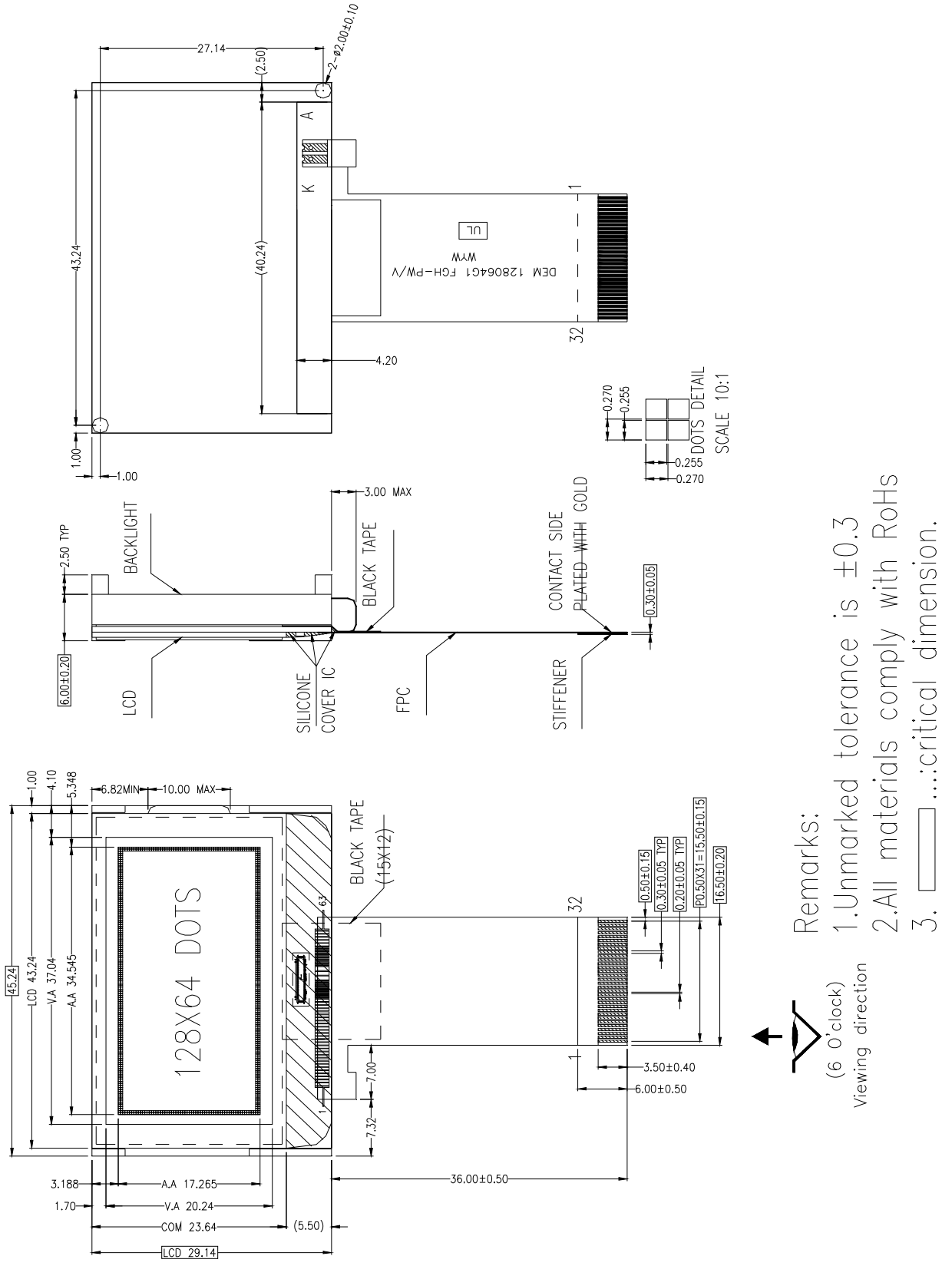
Module	LCD Type	Remark
DEM 128064G1 FGH-PW	FSTN Transflective Positive Mode	

- Viewing Direction : 6 O'clock
- Driving Scheme :1/ 65 Duty, 1/ 9 Bias
- Power supply : 3.3 V
- V_{LCD}(V0-Vss) :10.7 V
- Display Contents : 128 x 64 Dots
- Interface : Parallel & Serial
- LCD Driver : IST3004-TX
- RoHS Compliant

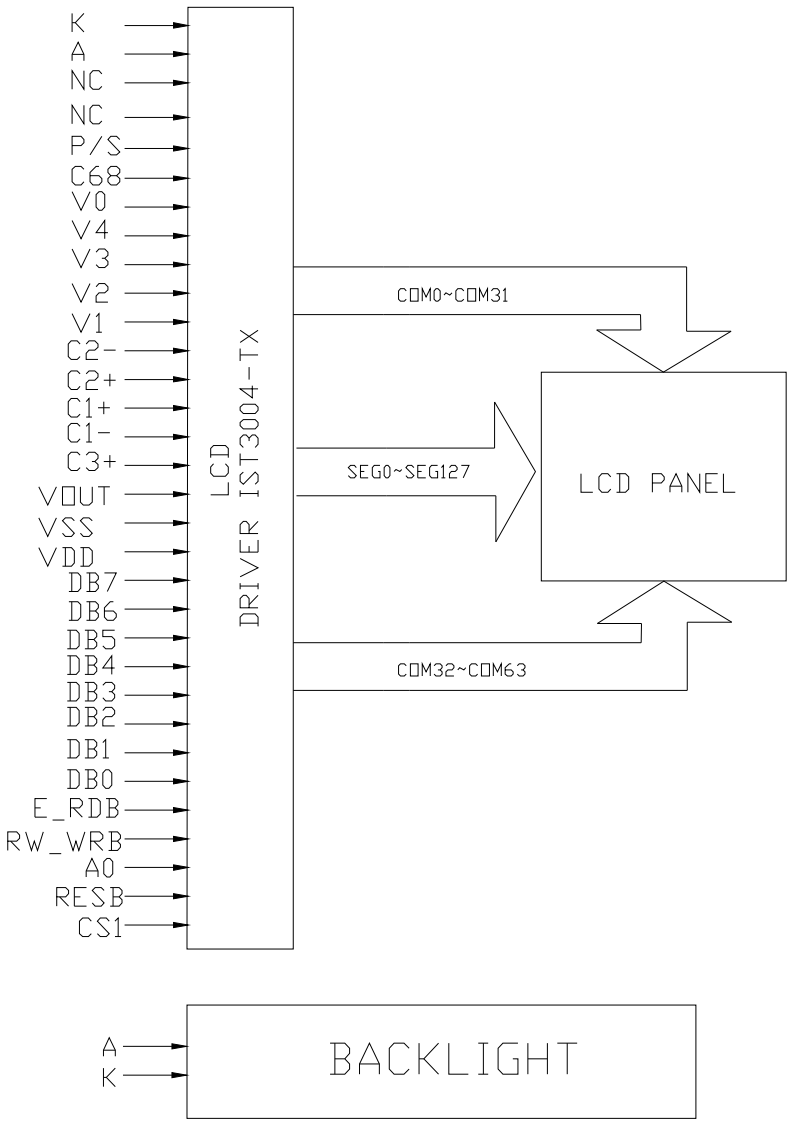
2. MODULE ARTWORK

- Module Size : 45.24mm x 29.14mm x 6.00mm(Without FPC)
- Viewing Area : 37.04mm x 20.24mm
- Active Area : 34.545mm x 17.265mm
- Dot Size : 0.255mm x 0.255mm
- Dot Pitch : 0.270mm x 0.270mm
- Dot Gap : 0.015mm

3. EXTERNAL DIMENSIONS (unit: mm)



4. BLOCK DIAGRAM



5. PIN ASSIGNMENT

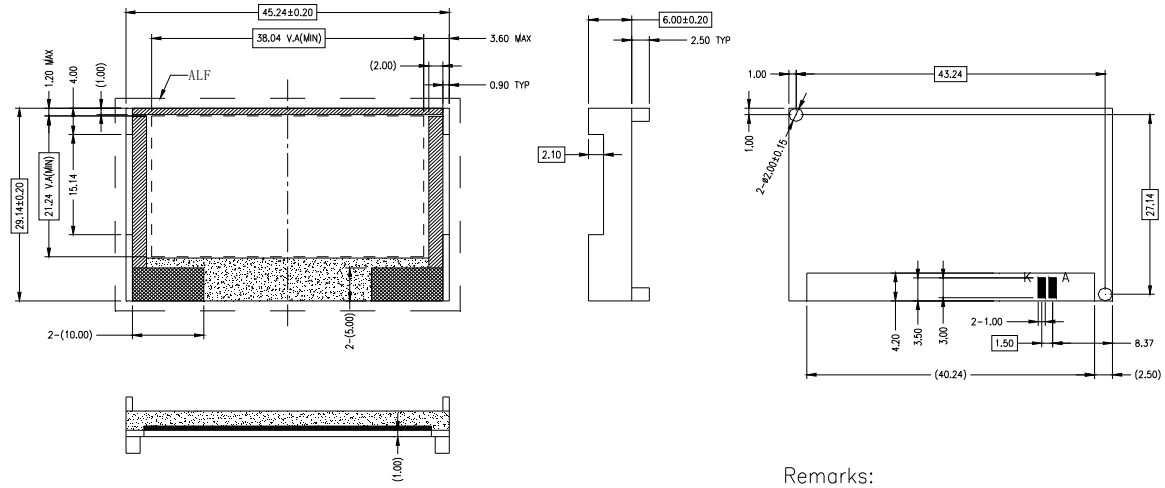
<table>
<tr><th>PinNo</th><th>Name</th><th>Description</th></tr>
<tr><td>1</td><td>K</td><td>Supply voltage for backlight LED-</td></tr>
<tr><td>2</td><td>A</td><td>Supply voltage for backlight LED+</td></tr>
<tr><td>3</td><td>NC</td><td>No connect</td></tr>
<tr><td>4</td><td>NC</td><td>No connect</td></tr>
<tr><td>5</td><td>P/S</td><td>Parallel / serial data input select input
<table>
<tr><td>P/S</td><td>Interface Mode</td><td>Chip Select</td><td>Data / instruction</td><td>Data</td><td>Read / Write</td><td>Serial clock</td></tr>
<tr><td>“H”</td><td>Parallel</td><td>CS1B</td><td>A0</td><td>DB0 to DB7</td><td>E_RDB RW_WRB</td><td>--</td></tr>
<tr><td>“L”</td><td>Serial</td><td>CS1B</td><td>A0</td><td>SDI (DB7)</td><td>Write only</td><td>SCL (DB6)</td></tr>
</table>
<NOTE> In serial mode, it is impossible to read data from the on-chip RAM. And DB0 to DB5 and E_RDB and
RW_WRB must be fixed to either “H” or “L”.</td></tr>
<tr><td>6</td><td>C68</td><td>Microprocessor Interface Select input pin in parallel mode
- C68 = “H” : 6800-series MPU interface
- C68 = “L” : 8080-series MPU interface</td></tr>
<tr><td>7</td><td>V0</td><td rowspan="5">LCD driver supply voltages
The voltage determined by LCD pixel is impedance-converted by an operational amplifier for application.
Voltages should have the following relationship;
V0 ≥ V1 ≥ V2 ≥ V3 ≥ V4 ≥ VSS
When the internal power circuit is active, these voltages are generated as following as following table according to the state of LCD bias.
<table>
<tr><td>LCD bias</td><td>V1</td><td>V2</td><td>V3</td><td>V4</td></tr>
<tr><td>1/9bias</td><td>(8/9) xV0</td><td>(7/9) xV0</td><td>(2/9) xV0</td><td>(1/9) xV0</td></tr>
</table></td></tr>
<tr><td>8</td><td>V4</td></tr>
<tr><td>9</td><td>V3</td></tr>
<tr><td>10</td><td>V2</td></tr>
<tr><td>11</td><td>V1</td></tr>
<tr><td>12</td><td>C2-</td><td rowspan="6">DC/DC voltage converter</td></tr>
<tr><td>13</td><td>C2+</td></tr>
<tr><td>14</td><td>C1+</td></tr>
<tr><td>15</td><td>C1-</td></tr>
<tr><td>16</td><td>C3+</td></tr>
<tr><td>17</td><td>VOUT</td></tr>
<tr><td>18</td><td>VSS</td><td>Ground</td></tr>
<tr><td>19</td><td>VDD</td><td>Voltage supply</td></tr>
<tr><td>20</td><td>DB7</td><td rowspan="8">8-bit bi-directional data bus that is connected to the standard 8-bit microprocessor data bus. When the serial interface selected (PS = “L”);
- DB0 to DB5 : high impedance
- DB6 : serial input clock (SCL)
- DB7 : serial input data (SDI)
When chip select is not active, DB0 to DB7 may be high impedance.</td></tr>
<tr><td>21</td><td>DB6</td></tr>
<tr><td>22</td><td>DB5</td></tr>
<tr><td>23</td><td>DB4</td></tr>
<tr><td>24</td><td>DB3</td></tr>
<tr><td>25</td><td>DB2</td></tr>
<tr><td>26</td><td>DB1</td></tr>
<tr><td>27</td><td>DB0</td></tr>
<tr><td>28</td><td>E_RDB</td><td>Read / Write execution control pin
<table>
<tr><td>C68</td><td>MPU Type</td><td>E_RDB</td><td>Description</td></tr>
<tr><td>H</td><td>6800-series</td><td>E</td><td>Read / Write control input pin
- RW = “H” : When E is “H”, DB0 to DB7 are in an output status.
- RW = “L” : The data on DB0 to DB7 are latched at the falling edge the E signal.</td></tr>
<tr><td>L</td><td>8080-series</td><td>/RDB</td><td>Read enable clock input pin
When / RDB is “L”, DB0 to DB7 are in an output status.</td></tr>
</table></td></tr>
<tr><td>29</td><td>RW_WRB</td><td>Read / Write execution control pin
<table>
<tr><td>C68</td><td>MPU Type</td><td>RW_WRB</td><td>Description</td></tr>
<tr><td>H</td><td>6800-series</td><td>RW</td><td>Read / Write control input pin
- RW = “H” : read
- RW = “L” : write</td></tr>
<tr><td>L</td><td>8080-series</td><td>/WRB</td><td>Write enable clock input pin
The data on DB0 to DB7 are latched at the rising edge of the /WRB signal.</td></tr>
</table></td></tr>
<tr><td>30</td><td>A0</td><td>Register select input pin
- A0 = “H” : DB0 to DB7 are display data
- A0 = “L” : DB0 to DB7 are control data</td></tr>
</table>

31	RESB	Hardware Reset input pin When RESB is “L”, initialization is executed.
32	CS1B	Chip select input pins Data / instruction I/O is enabled only when CS1B is “L” and CS2 is “H”. when chip select is non-active, DB0 to DB7 may be high impedance

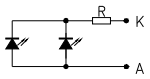
6. BACKLIGHT ELECTRICAL /OPTICAL CHARACTERISTICS

Electronics/Optical Specifications: (Color: White)

	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Forward Voltage	V_f	2.9	3.1	3.3	V	
Forward Current	I_f	--	15	40	mA	V_f=3.1V
Power Dissipation	P_d	--	--	0.14	W	V_f=3.1V
Reverse Voltage	V_R	--	--	5	V	--
Reverse Current	I_R	--	--	0.1	mA	V_r=5V
Luminous Intensity	I_V	400	600	900	cd/m^2	V_f=3.1V
Luminous Uniformity	$\triangle I_V$	70	--	--	%	V_f=3.1V
Color Chromaticity	X	0.26	--	0.33	—	I_f=20mA Ta=25° C
	Y	0.26	--	0.33	—	Each chip



3.Circuit Diagram (LED 1X2=2 SMD) Color: WHITE



Remarks:
1.Unmarked tolerance is ±0.3
2.All materials comply with RoHs
3. ▭ ...:critical dimension.
4.COLOR:WHITE
5: LED lifetime 50.000 hours

7. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Unit
Power Supply Voltage	V_{DD}	-0.3 ~ 7.0	V
	V0, VOUT	-0.3~15.0	V
Power Supply Voltage (VDD Standard)	V1,V2,V3,V4	-0.3 to V0	V
Input Voltage Range	VIN	-0.3 to VDD + 0.3	V
Operating Temperature	TOPR	-20~+70	°C
Storage Temperature	TSTR	-30~+80	°C

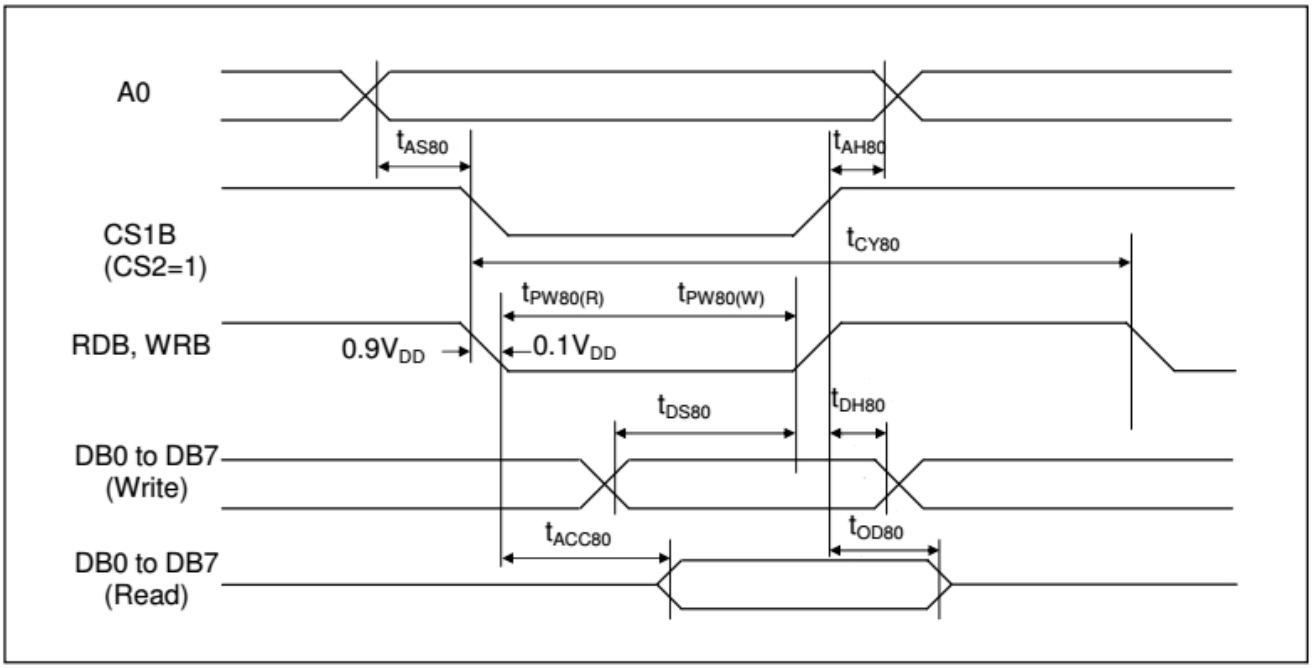
8. ELECTRICAL CHARACTERISTICS

8-1. DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Operating Voltage	V_{DD}	3.0	3.3	3.6	V	
LCD Voltage	V_{LCD}	10.4	10.7	11.0	V	V0-V_{SS}
Current Consumption	I_{DD}	TBD	TBD	TBD	uA	

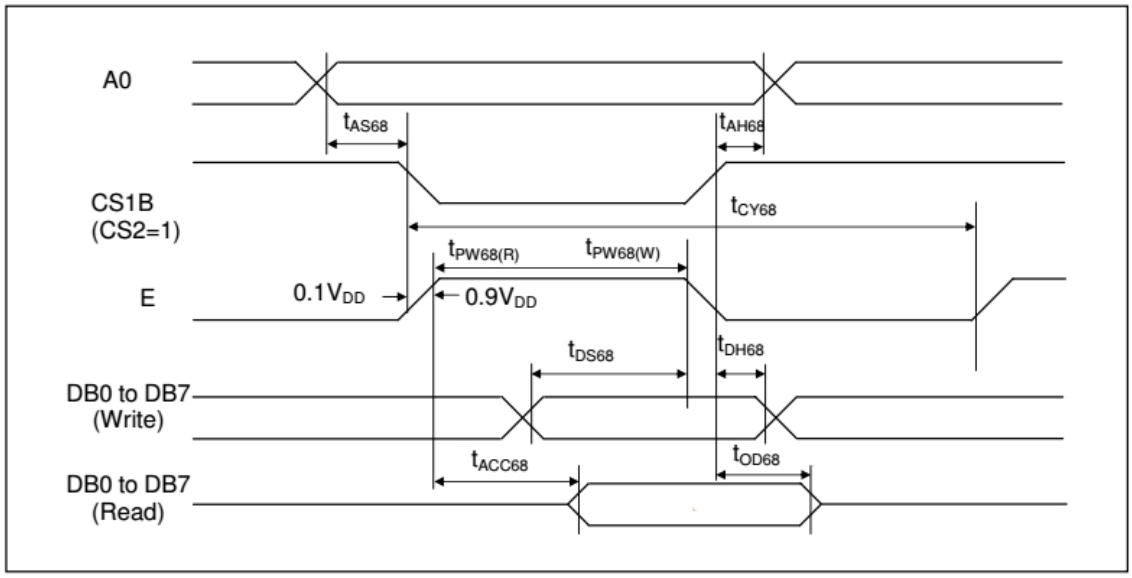
8-2. AC Characteristics

Read / Write Characteristics (8080-series MPU)



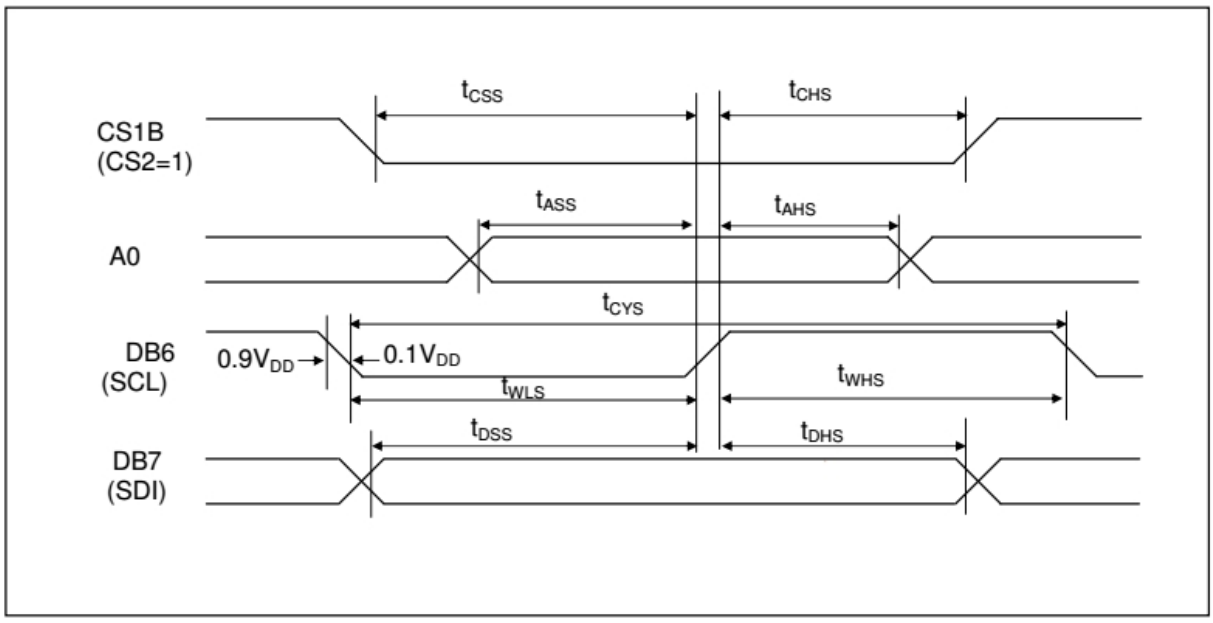
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time	A0	tAS80 tAH80	0 0	-	-	ns	
System cycle time		tCY80	300	-	-	ns	
Pulse width (WRB)	RW_WRB	tPW80(W)	150	-	-	ns	
Pulse width (RDB)	E_RDB	tPW80(R)	150	-	-	ns	
Data setup time Data hold time	DB7 to DB0	tDS80 tDH80	60 0	-	-	ns	
Read access time Output disable time		tACC80 tOD80	140 -	-	- 10	ns	(No load)

Read / Write Characteristics (6800-series Microprocessor)



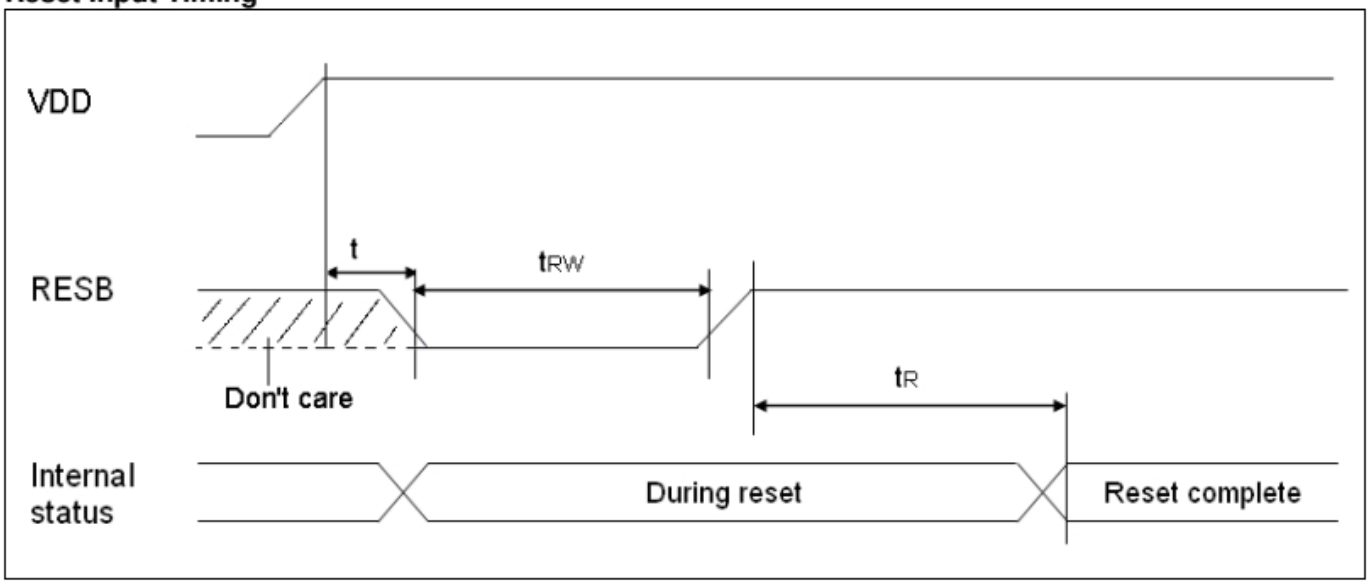
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time	A0	 tAH68	0 0	-	-	ns	
System cycle time		tCY68	300	-	-	ns	
Pulse width (E)	RW_WRB	tPW68(W)	150	-	-	ns	
Pulse width (E)	E_RDB	tPW68(R)	150	-	-	ns	
Data setup time Data hold time	DB7 to DB0	tDS68 tDH68	60 0	-	-	ns	
Read access time Output disable time		tACC68 tOD68	140 -	-	- 10	ns	(No load)

Serial Interface Characteristics



Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Serial clock cycle SCL high pulse width SCL low pulse width	DB6 (SCL)	tCYS tWHS tWLS	200 90 90	- - -	- - -	ns	
Address setup time Address hold time	A0	tASS tAHS	45 45	- -	- -	ns	
Data setup time Data hold time	DB7 (SDI)	tDSS tDHS	45 45	- -	- -	ns	
CS1B setup time CS1B hold time	CS1B	tCSS tCHS	90 90	- -	- -	ns	

Reset Input Timing

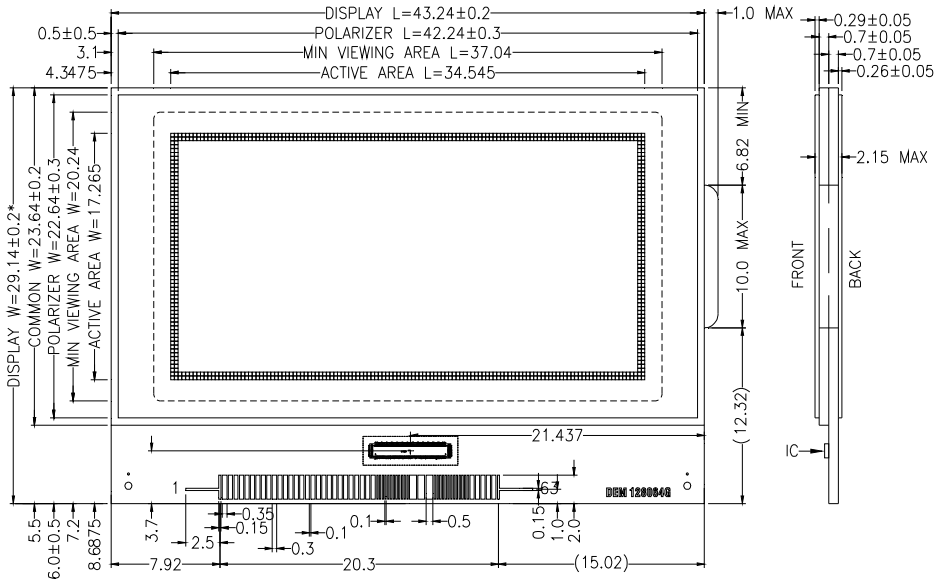


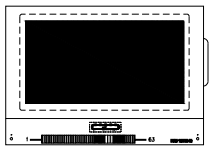
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Reset low pulse width	RESB	tRW	2	-	-	us	
Reset time	-	tR	-	-	2	us	
Reset time	RESB	t	0	-	-	us	

9. INSTRUCTION DESCRIPTION

INSTRUCTION	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Display ON / OFF	0	0	1	0	1	0	1	1	1	DON	LCD display On/Off control DON = 0 : display OFF DON = 1 : display On
Display starting line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Specify the line address for the first COM output
page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y7	Y6	Y5	Y4	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB
Read status	0	1	BUSY	ADC	ON/OFF	RESB	0	0	0	0	Read the internal status
Write display data	1	0	Write data								Write data into Display RAM
Read display data	1	1	Read data								Read data from Display RAM
ADC select	0	0	1	0	1	0	0	0	0	ADC	SEG output direction select ADC = 0 : SEG0 → SEG131 ADC = 1 : SEG131 → SEG0
Reverse display ON / OFF	0	0	1	0	1	0	0	1	1	REV	Normal / Reverse display select REV = 0 : Reverse display off REV = 1 : Reverse display on
Entire display ON / OFF	0	0	1	0	1	0	0	1	0	EON	Entire display On/Off control EON = 0 : Entire display off EON = 1 : Entire display on
LCD bias select	0	0	1	0	1	0	0	0	1	BS	Select LCD bias
Set Read-modify-write (RMW)	0	0	1	1	1	0	0	0	0	0	Set Read-modify-write mode
Clear RMW	0	0	1	1	1	0	1	1	1	0	Clear Read-modify-write mode
S/W Reset	0	0	1	1	1	0	0	0	1	0	S/W Reset
SHL select	0	0	1	1	0	0	SHL	×	×	×	COM output direction select SHL = 0 : COM0 → COM63 SHL = 1 : COM63 → COM0
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Regulator resistor select	0	0	0	0	1	0	0	R2	R1	R0	Select internal resistance ratio of the regulator resistor
Set reference voltage mode	0	0	1	0	0	0	0	0	0	1	Set reference voltage mode (double byte command)
Set reference voltage register	0	0	×	×	SV5	SV4	SV3	SV2	SV1	SV0	Set reference voltage register
Set static indicator mode	0	0	1	0	1	0	1	1	0	SM	Set static indicator mode (double byte command)
Set static indicator register	0	0	×	×	×	×	×	×	S1	S0	Set static indicator register
Power save	-	-	-	-	-	-	-	-	-	-	Compound Instruction of display OFF and entire display ON
NOP	0	0	1	1	1	0	0	0	1	1	No operation (dummy command)
Set Booster Ratio select mode	0	0	1	1	1	1	1	0	0	0	Set Booster ration select mode (double byte command)
Set Booster Ratio register	0	0	x	x	x	x	x	x	BT1	BT0	Set Booster ration BT[1:0] = 00 : x2, x3, x4 BT[1:0] = 01 : x5 BT[1:0] = 11 : x6 BT[1:0] = 10 : (don't use)
Test Instruction	0	0	1	0	0	0	1	0	0	0	Test command (don't use)

10. LCD ARTWORK





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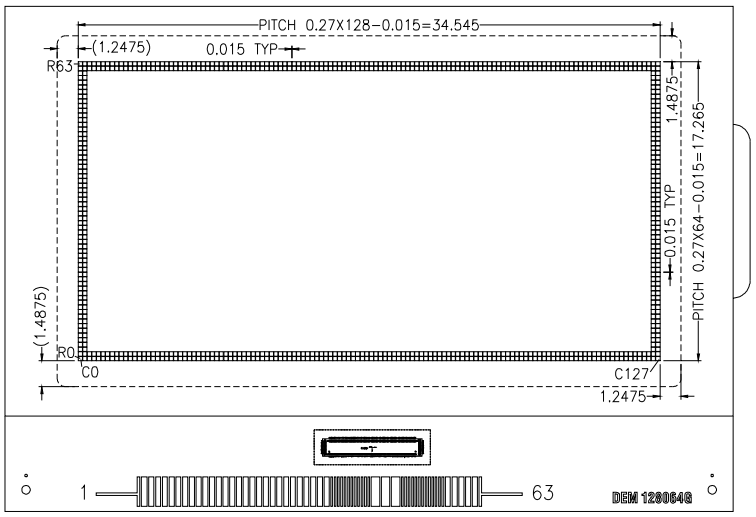
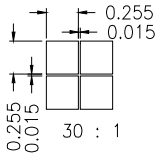
11.LABELLING&PAD CONFIGURATION

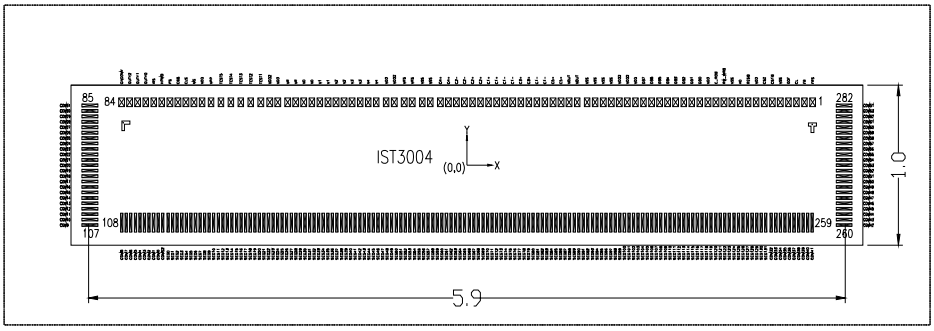


IC NO.	CONFIGURATION
COM31	COM31[R31(C0-C127)]
COM30	COM30[R30(C0-C127)]
COM1	COM1[R1(C0-C127)]
COM0	COM0[R0(C0-C127)]
SEG0	SEG0[C0(R0-R63)]
SEG1	SEG1[C1(R0-R63)]
SEG126	SEG126[C126(R0-R63)]
SEG127	SEG127[C127(R0-R63)]
COM32	COM32[R32(C0-C127)]
COM33	COM33[R33(C0-C127)]
COM62	COM62[R62(C0-C127)]
COM63	COM63[R63(C0-C127)]



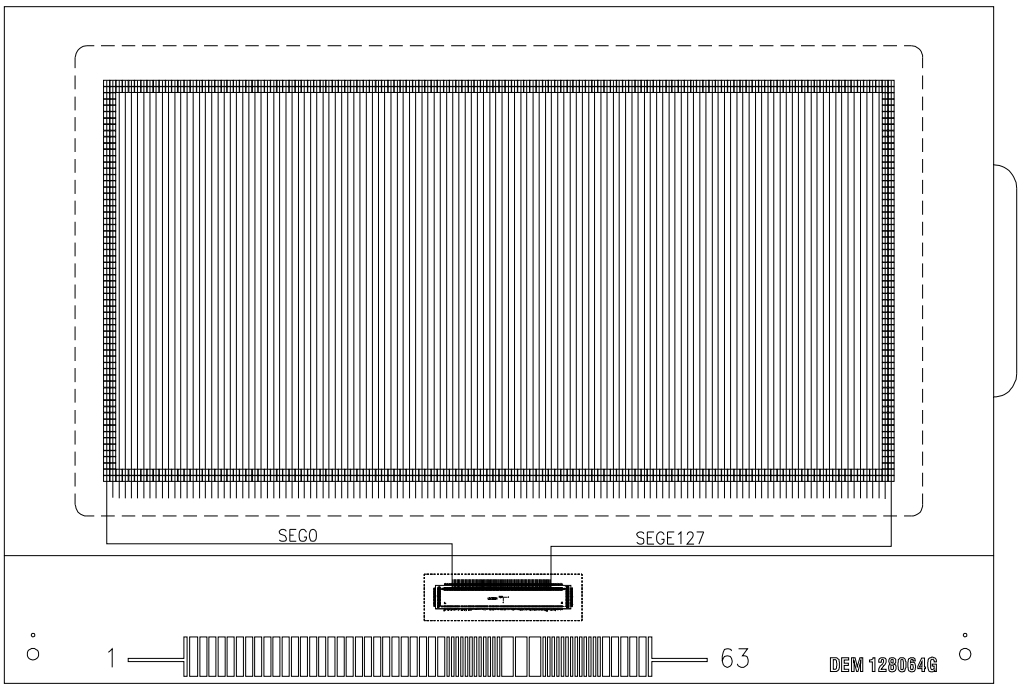
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MM
TOLERANCES:±0.1MM

12.PAD CONFIGURATION



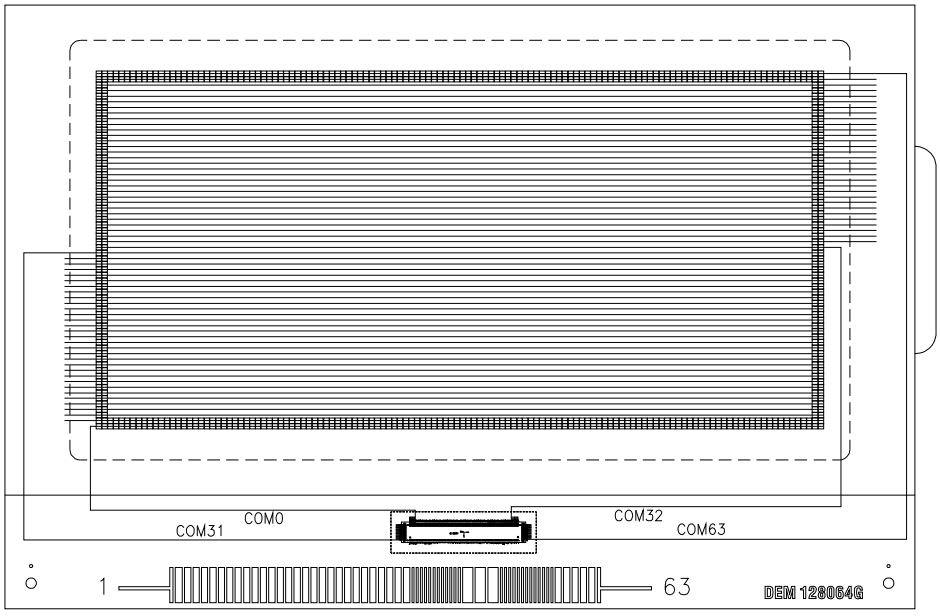
PAD NO.	PAD CONFIGURATION	PAD NO.	PAD CONFIGURATION
1-29	NC	46	DB6
30	PS	47	DB5
31	C68	48	DB4
32	V0	49	DB3
33	V1	50	DB2
34	V2	51	DB1
35	V3	52	DB0
36	V4	53	E_RDB
37	C2-	54	RW_WRB
38	C2+	55	A0
39	C1+	56	RESB
40	C1-	57	CS1B
41	C3+	58-63	NC
42	VOUT		
43	VSS		
44	VDD2,VDD		
45	DB7		

13.SEG LAYOUT



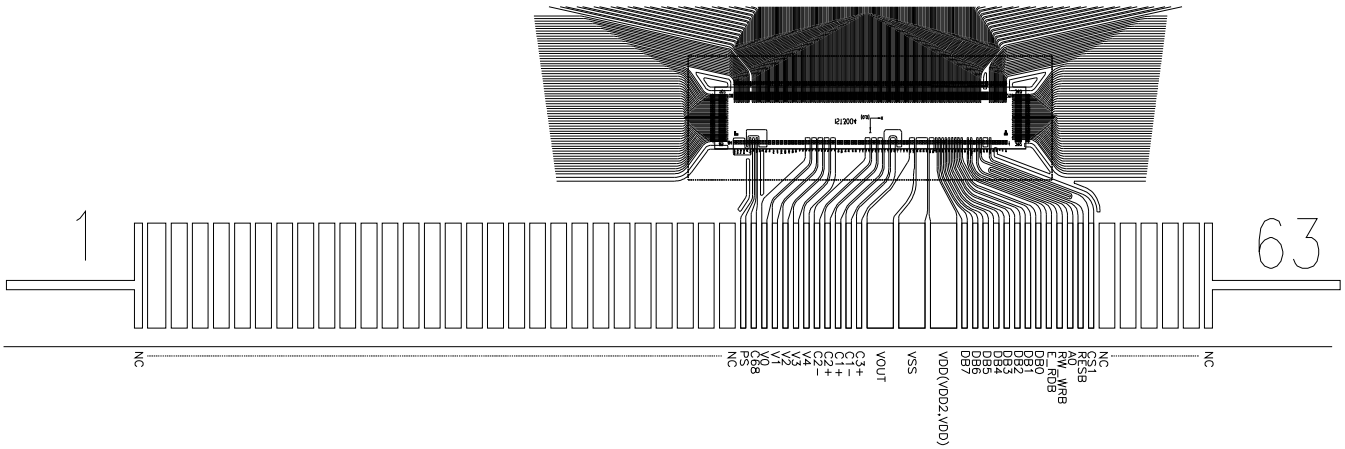
SEG

14. COM LAYOUT



COM

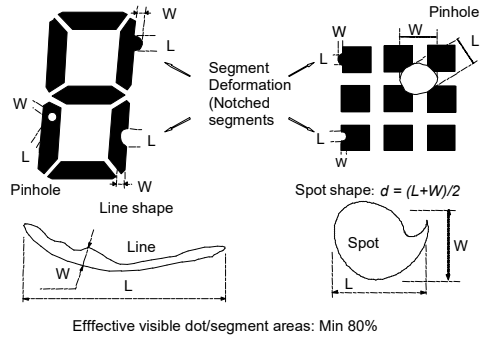
15. IC LAYOUT



16. QUALITY DESCRIPTION

DEFECT SPECIFICATION:

a: Table for Cosmetic defects
(Note: nc = not counted).
Sizes and number of defects
(Max. Qty)



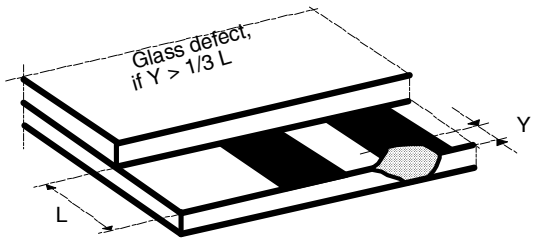
Defect Type	Max. defect size [µm]d or L W	Max. Quantity.
Black or White Spots	d ≤ 100	nc
	100< d ≤ 200	5
Black or White Lines	-- W ≤ 10	nc
	L ≤ 5000 W ≤ 30	3
	L ≤ 2000 W ≤ 50	2
Pinhole	d ≤ 100 100< d ≤ 200	nc1/segment
(Total defects)		(5)
Segment Deformation	W ≤ 100	nc
Bubble (e.g. under pola)	d ≤ 150	nc
	200< d ≤ 400	3
	400< d ≤ 600	1

Examples/Shapes

b: Glass defects

b1:Glass defects at contact ledge

b2:Glass chipping in other areas shall not be in conflict



with the product's function.

17. ACCEPT QUALITY LEVEL (AQL).

17.1. AQL standard value: Critical defect =0.1; Major defect=0.65; Minor defect =2.5.

17.2. Inspection Standard: MIL-STD-105E Table Normal Inspection Single Sampling Level II.

18. RELIABILITY TEST CONDITION

Operating life time: 50,000 hours (at room temperature without direct irradiation of sunlight)
Reliability characteristics shall meet following requirements.

Test Item	Test Condition
High Temperature Storage	+80°C x 96HR
Low Temperature Storage	-30°C x 96HR
High Temperature Operation	+70°C x 96HR
Low Temperature Operation	-20°C x 96HR
High Temperature, High humidity	+60°C x 90%RH x 96HR
Thermal Shock	-30°C x 30min → 25°C x 10s → +80°C x 30min x 5 Cycles
Vibration Test	Frequency x Swing x Time 40Hz x 4mm x 4hrs
Drop Test	Height x no. of drop 1.0m x 6 drops

19. LCD MODULES HANDLING PRECAUTIONS

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

  -Be sure to ground the body when handling the LCD module.

  -Tools required for assembly, such as soldering irons, must be properly grounded.

  -To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

  -The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions

  When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below -20℃).Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

20. OTHERS

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
  - Exposed area of the printed circuit board
  - Terminal electrode sections.